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Clinical Paper
TMJ Disorders

A comparison of the outcomes of four minimally invasive treatment methods for anterior disc displacement of the temporomandibular joint

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Abstract. The purpose of this study was to compare the effectiveness of four non-surgical conservative treatment methods for temporomandibular disorders (TMD). The study group comprised 40 patients with unilateral TMD who fell into group II of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). Patients were divided into four groups according to the treatment method: splint therapy, arthrocentesis, medical therapy, and low-level laser therapy. Magnetic resonance imaging (MRI) was performed before treatment and at the 1-month follow-up. The type of TMD and joint effusion were examined in the MRI scans. Patients were followed up after treatment for 6 months. Mouth opening increased and pain scores decreased at 1, 3, and 6 months after treatment in all groups ($P < 0.05$). No statistically significant difference in the improvements in clinical symptoms was observed between the groups. A positive correlation was found between pain and effusion ($P < 0.05$). A significant positive relationship was also found between internal derangement and effusion ($P < 0.05$). All treatment methods were successful at improving the clinical symptoms. It was determined that the effusion demonstrated on MRI was associated with pain. Although the symptoms improved after treatment, joint effusion did not show any decrease in the 1-month follow-up MRI.

Key words: arthrocentesis; low-level laser therapy; medical therapy; MRI; splint therapy; temporomandibular disorders.

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Temporomandibular disorders (TMD) are a group of diseases that affect the temporomandibular joint (TMJ) and supporting structures[1]. Common symptoms include clicking, pain, and tenderness in the pre-auricular area and masticatory muscles, and limited mouth opening. Temporomandibular disorders are more common in females than males, and more common-

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ly affect those in the age range of 20 to 40 years. Many aetiological factors play a role in the development of TMD, but the exact aetiology remains unknown[2]. Chronic microtrauma to the TMJ is the most important factor[3,4]. Repetitive microtrauma causes bleeding in the joints, effusion, and a decrease in lubrication. The change in joint structure may cause inflammation of the joint capsule or retrodiscal region, and the amount of mouth opening may thereby be reduced[4,5].

The aim of intra-articular treatment of trauma-induced inflammation and pathologies is to control the macrotrauma and microtrauma that occur in the joint, allowing the inflamed tissue to regenerate, and to reduce the pressure inside the joint[6]. A past history of discomfort along with clinical assessments and standardized joint imaging are of great importance in the diagnosis of TMD. The most important problem in the clinical diagnosis of TMD is the lack of standardized criteria for the evaluation of the lower disorder classes. The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were compiled to generate standard criteria for the diagnosis of the most common disorders of the TMJ and masticatory muscles. The RDC/TMD were established based on long-term epidemiological studies and consist of two parts. The first section includes physical symptoms of TMD, and the second section includes psychosocial factors associated with TMD[7].

TMJ imaging is beneficial in determining the relationship between the hard and soft tissues that form the TMJ, and allows tissue integrity to be evaluated. Magnetic resonance imaging (MRI) is considered the gold standard for the evaluation of TMD. There are several advantages to this method: it is not invasive; it does not constitute ionizing radiation; the disc and joint position together can be evaluated on images in the open and closed mouth positions; it can provide valuable information about the condition of the joint; both the soft tissues and hard tissues are evaluated; direct transverse, sagittal, and coronal images can be obtained; it provides multi-slice imaging; tissue characterization can be made; the blood flow can be viewed; and it does not cause any known biological damage[8].

The goal of treatment for TMD is the elimination or reduction of pain and joint sounds and a return to normal TMJ function[2]. The treatment of TMD involves a diet of soft foods, behaviour modification, pharmacotherapy, inter-occlusal splints, intra-articular injections, physical therapy, arthrocentesis, arthroscopy, and open joint surgery. In recent years, low-level laser therapy (LLLT) has been introduced as a non-invasive physical method for the treatment of TMD and myofascial pain[9–12]. Because the pathogenic pathways cannot be clearly defined, reversible treatment, minimally invasive treatment, or no treatment at all, is generally preferred. If conservative treatment fails, surgical treatment is then considered.

The purpose of this study was to evaluate the short-term clinical and radiological effectiveness of the four main non-surgical treatment methods for TMD: pharmacotherapy, inter-occlusal splints, LLLT, and arthrocentesis therapy.

Materials and methods

This study was conducted with the approval of the local ethics committee (Clinical Research Ethics Committee of the Experimental Medicine Research and Application Centre, Ondokuz Mayıs University) and written consent was obtained from the patients.

Based on data from a previous study[13], a sample size of 40 subjects was calculated using the G*Power software program version 3.1.9.2 (Heinrich-Heine-Universität Düsseldorf, Germany; power 0.95, $\alpha = 0.05$, $\beta = 0.05$). The recruitment of patients began in 2012 and finished in 2013. A flow chart of patient participation and the study profile is given in Fig. 1.

The inclusion criteria consisted of unilateral painful TMD, falling into group II according to the RDC/TMD: disc displacement (DD) with reduction, DD without reduction with limited opening, and DD without reduction without limited opening. The contralateral symptom-free TMJs of the patients were evaluated as the control group for the determination of effusion.

The exclusion criteria were as follows: presence of a known connective tissue or autoimmune disease, prior TMJ surgery, degenerative joint disease, osteoarthritis, history of major jaw trauma, dentofacial deformity, and concurrent use of steroids, muscle relaxants, or narcotics.

All of the patients were assessed clinically according to the RDC/TMD specifications, and the following variables were recorded: joint pain using a visual analogue scale (VAS; 0–10), joint noises (clicking, crepitus, or none), and maximum mouth opening (MMO) measured as the distance between the upper and lower incisors. Patients were followed up at 1, 3, and 6 months. MMO, the VAS pain score, and joint sounds were noted at each follow-up visit (Table 1). Joint sounds were evaluated by finger palpation. The clinical examination and diagnosis were made by one investigator, and the patients were sent for a radiological examination by the same surgeon. The patients underwent MRI, and a radiological diagnosis was made by the radiologist who was blinded to the clinical diagnosis. The MRI images were examined to determine the type of DD and joint effusion. MRI images were obtained before treatment and at the 1-month follow-up. All subjects were then allocated randomly to one of four treatment groups by another investigator who did not know the clinical or radiological diagnosis. All treatment protocols were applied and followed up by the principal surgeon.

A 0.5 Tesla MRI scanner (SIGNA; General Electric, Inc. Milwaukee, WI, USA), with a 6 × 8 cm diameter surface coil and 3-mm thick sections, a 15-cm field of view, and 256 × 192 or 256 × 256 matrix, was used. T2-weighed images were obtained at 1500/20 ms or 1500/80 ms repetition time (TR)/echo time (TE), and T1-weighed images at between 200/11 ms TR/TE and 340/17 ms TR/TE. The MRI protocol included oblique sagittal and oblique coronal images in order to obtain a better visualization of the disc–condyle relationship. All subjects underwent MRI of both TMJs in the closed and open mouth positions; a wooden intermaxillary device was used to obtain the maximal mouth opening position.

The MRI images were used to determine the type of TMD and joint effusion. Effusion was identified as a high signal intensity providing a bright image in the upper and lower joint space. Effusion in the MRIs was graded according to the following criteria: no effusion (joint without effusion) = 0; moderate effusion (joint with linear high density on the joint surfaces; Fig. 2) = 1; marked effusion (joint with localized concentration in the lower and upper joint space and containing retrodiscal tissues; Fig. 3) = 2.

Group 1 patients underwent splint therapy ($n = 10$). Hard acrylic occlusal appliances were fabricated and adjusted to have maximal contact in centric occlusion, as well as symmetrical anterior contact in a protrusive movement of the mandible and canine guidance in lateral jaw movement. Patients were advised to use the stabilization splint for two-thirds of the day for 6 months.

Group 2 patients underwent arthrocentesis therapy ($n = 10$). Arthrocentesis was performed to the upper joint space, as recommended by Nitzan et al.[14]. The

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